THE EYE AS A COSMIC RAY DETECTOR

S. Hitchcock
March 28, 1981

Astronauts observed flashes of light when on translunar or transearth VOYAGES or over the polar part of Skylab orbits[1]. Patterns of these white flashes (see fig. 1) noted in space (and duplicated in cyclotron experiments on earth) are thought to occur when a high mass cosmic ray passes through the retina ionizing a few atoms or molecules which induce signals recieved at the optic nerve.

Cosmic rays are high energy charged particles originating, in order of { DECREASING FLUX INCIDENT ON THE EARTHS UPPER ATMOSPHERE } from the Galaxy, the sun, and extragalactic sources[2]. These rays consist of about 85% protons, 14% alpha-particles, 1% electrons, and a very small portion of heavy nuclei[3].

Additional sources may include Cerenkov radiation and ionization in the retina by alpha particles produced by nuclear collisions with high energy Van Allen belt protons. Cerenkov radiation is a "shock wave" of light emitted when a particle near the speed of light enters a substance in which the speed of light is slower than the speed of the particle (about 40% slower in the human eye). The flash created by such a particle should fill the entire eyeball accounting for reported out-of-focus "diffuse clouds" (see fig. 1).

Laboratory experiments with cyclotrons found that in blindfolded dark adapted subjects short bursts of high energy ions through the eyes produced flashes similar to those reported in space flights. However no flashes were reported with beams sent through the brain and optic nerve[3]. Thereby locating the phenomena within the eye.

Indications of recovery from cosmic ray damage[4] to the eye and motion independent retinal response[5] to these particles has been found.

IN CONCLUSION WE SEE THAT THE EYE CAN DETECT PARTICLES AND PHOTONS OUTSIDE THE NORMAL COLOR SPECTRUM OF LIGHT[6].

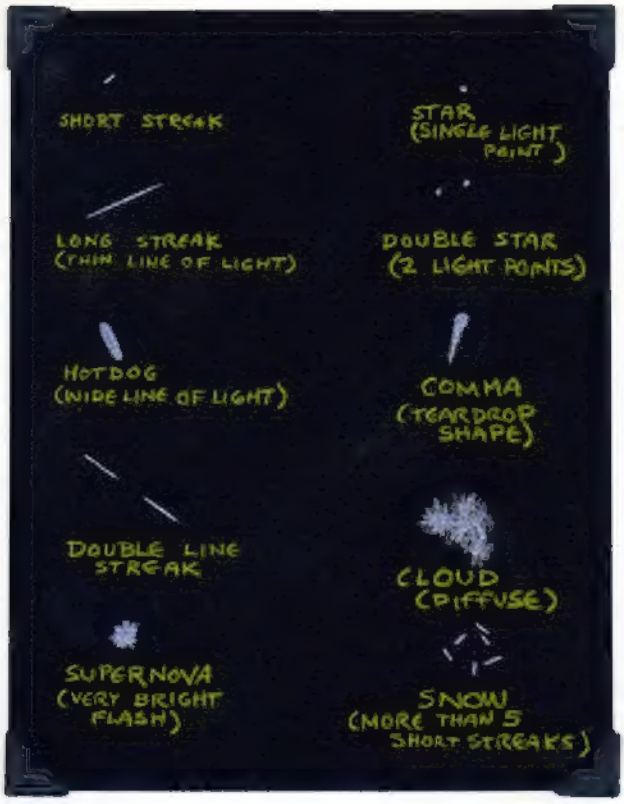

Fig. 1
SHAPES AND SIZES OF LIGHT FLASHES NOTED IN SPACE AND CYCLOTRON EXPERIMENTS.

REFERENCES:

1. EXPLORATION OF THE UNIVERSE by G.O. Abell 1975; Holt, Reinhart and Winston

2. GLOSSARY OF ASTRONOMY AND ASTROPHYSICS by J. Hopkins 1976; University of Chicago Press

3. "LIGHT FLASH OBSERVATIONS" by T.F. Budinger et al 1978, NASA paper #N 78-17100

4. "COSMIC RAY EFFECTS ON THE EYES OF RATS FLOWN ON Cosmos 782" by D.E. Philpott et al 1979; NASA paper # N79-11669

5. "COSMIC RAY EFFECTS ON THE EYES OF STATIONARY AND CENTRIFUGED RATS FLOWN ON Cosmos 936 EXPERIMENT K-207" by D.E. Philpott et al 1979 NASA paper #N79-11678

6. FEYNMANN LECTURES ON PHYSICS VOL 1. by Feynmann et al 1963; Addison-Wesley Pub. Co.